

Reliable Power—Worldwide

Northern Power Systems designs, builds, and installs high reliability electric power systems. Northern has installed over 800 systems worldwide in the past 25 years, earning a reputation for delivering top-quality energy solutions.

where there is no utility line

electricity from the wind and sun

quality, cost control, and high reliability

r e m o t e p o w e r

r e n e w a b l e e n e r g y

d i s t r i b u t e d g e n e r a t i o n

w i n d t u r b i n e t e c h n o l o g y



High Quality Power Solutions for Distributed Generation Applications





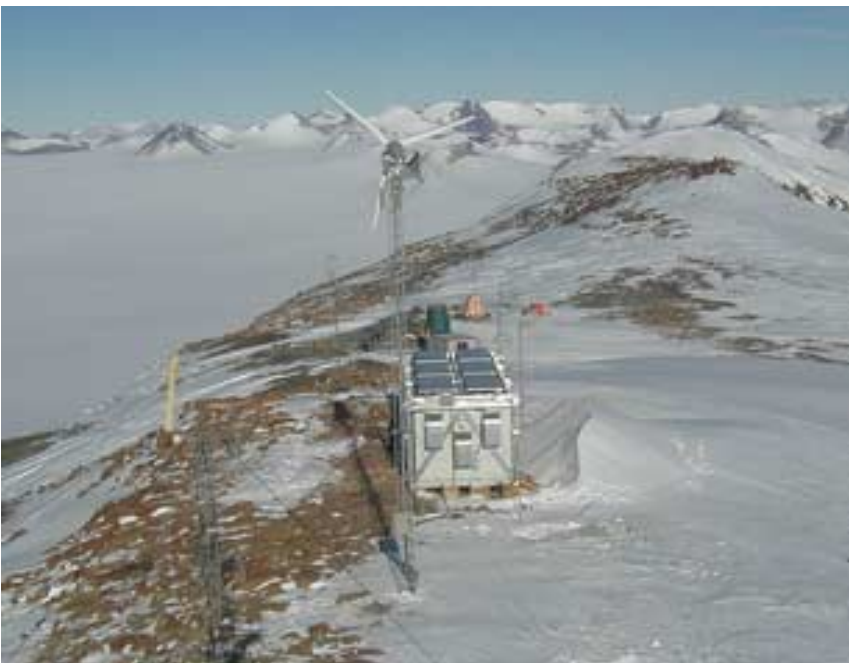
Company Overview

- World class power system provider
- Value-added EPC contractor
- Proprietary Technology
 - Systems controls
 - Power Electronics
- Wind Turbines
- 27 years experience
- Over 800 systems installed in 40 countries on 7 continents





Industrial Infrastructure



Providing high quality, reliable power solutions for Industrial Infrastructure applications across the globe



Renewable Energy Integration



Providing renewable energy solutions that reduce GHG emissions and lower the cost of on-site generation suitable for northern climates

Power Quality



Providing highly reliable on-site energy solutions that can achieve significant cost savings to Commercial and Industrial companies



Wind Turbine Technology

Northern's goal is to develop and commercialize NPS wind turbine technology on a significant scale through partnerships and licensing



North Wind 100



St. Paul Island, Alaska



Public power supply providing electricity and space heat to an industry/airport facility





St. Paul Island, Alaska

- **System:** Stand Alone Utility: Combined Heat and Power
- **Configuration:** High Penetration/No Storage Wind-Diesel
- **Size:** 500 kW
- **Application:** Public Power Supply, Providing Electricity and Space Heat to Industrial/Airport Facility
- **Location:** Pribilof Islands, Bering Sea
- **Peak Load:** 160 kW (With Load Growth Planned)
- **Customer:** Tanadgusix Corporation (TDX)
- **Funding:** Commercial, lease based
- **Cost of Energy:** + \$.21/kWh (Current Diesel Grid Cost is \$.34/kWh)





POSS Camp Facility



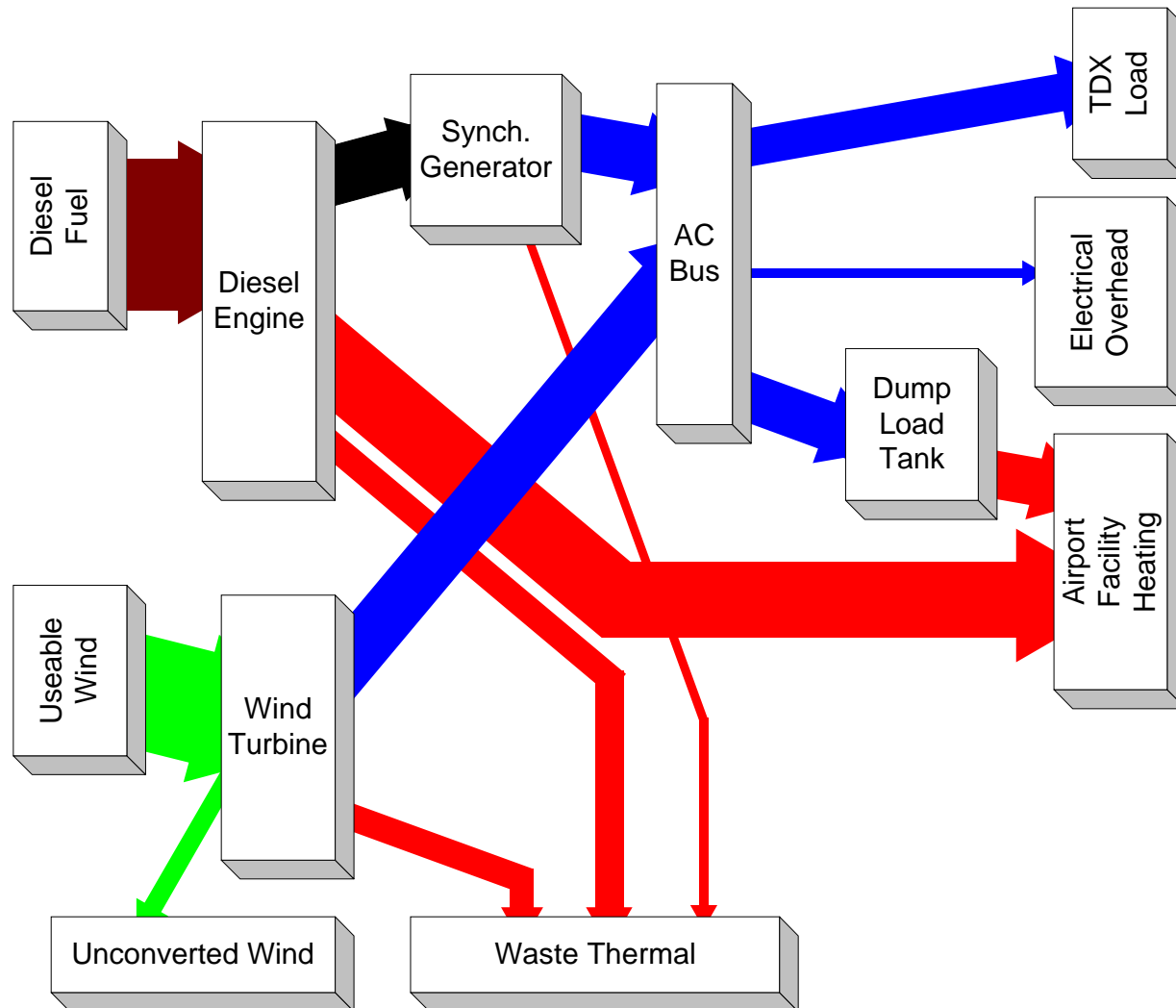


System Description

- 225 kW Wind Turbine
- 2 x 150 kW Diesel Gensets
- Digital Engine Controls
- NPS Components
 - System Controllers/
RemoteView™
 - Synchronous Condenser
 - Heating and Thermal Plant
 - Integrated Shelter
 - Secondary Load Regulator



TDX Energy Flow Diagram





Renewable Hybrid Economics

- System economics are dependant on:
 - Available resources
 - Value use for the secondary load
 - Delivered price of fuel
- Ultimate cost-of-energy is a function of:
 - Equipment capital costs
 - Maintenance and fuel costs
- Fossil-fuel generated power costs are dominated by delivered fuel and on-site maintenance
- Renewable system costs are dominated by upfront capital costs





Economics (50 kW - 5MW Systems)

Costs: Life Cycle Energy Capital

<u>Power Source</u>	<u>(\$/kWh)</u>	<u>(\$/kW)</u>
Diesel Engine	.14-.30	0.6
Natural Gas	.07-.09	0.6
Wind Energy	.07 -.12	2.0
Solar Energy	.25 -.35	9.0
Fuel Cells	<i>coming down</i>	

Power Storage

Hydrogen	<i>not here yet</i>	
Battery	.10 (energy storage cost)	
Flywheels	<i>very high</i>	





Lime Village, AK

- 12 kW Photovoltaic Array
- 100 kWh Battery Bank
- 35 kW Diesel Genset
- NPS Components
 - System Controls
 - RemoteView™





Green Mountain Coffee Roasters, VT

- 100 kW LP Gas Genset
- Water Jacket Heat Recovery
- Exhaust Gas Heat Recovery
- Digital Engine Controls
- Controlled Utility Interface
- Utility Paralleling Switchgear



GREEN MOUNTAIN COFFEE ROASTERS

COMBINED HEAT AND POWER SYSTEM
WATERBURY, VERMONT



Monhegan Island, ME

- Diesel Genset(s)
 - 2x 113 kW Turbo Charged
 - 1x 65 kW Naturally Aspirated
- 4160 VAC Island Distribution
- Switchgear/Controls
 - Expandable to Incorporate Wind and PV
- NPS Components
 - Automated Controls/Switchgear
 - RemoteView™



MONHEGAN PLANTATION POWER DISTRICT
MULTIPLE DIESEL GENERATION SYSTEM
MONHEGAN ISLAND, MAINE



Hybrid Cost Characterizations

EITHER

- High Capital Cost of Renewables
- High Cost of Natural Gas Operations

OR

- Low Operating Cost of Renewables
- Low Capital Cost of Natural Gas Generators





Hybrid Value Proposition

- Firm-Up Renewable Energy Sources
 - Dispatchability
 - Generation Cost Security Hedge
 - Greener Shade of Energy

Jito Coleman, President
Northern Power Systems

